The code for HW1 is separated into question_1.py、question_2.py and question_3.py to represent each question in HW1. I have written my function in function.py for question_1.py、question_2.py and question_3.py to use. I have written environment information in requirements.txt.

Question 1

fig.1 transforms “foreman_qcif_0_rgb.bmp” from the RGB to YCbCr420 color space

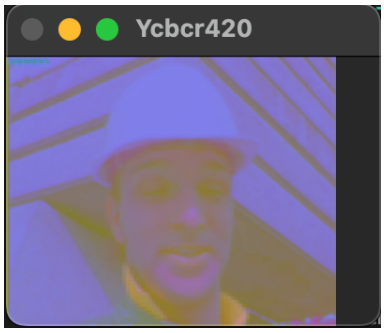
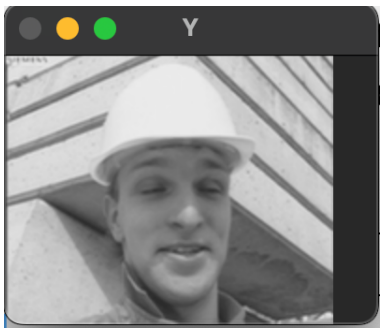


Fig. 1

Fig. 2 is a Y image from Ycbcr420、Fig. 3 is a cb image from Ycbcr420 and Fig. 4 is a cr image from Ycbcr420



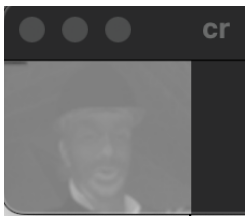


Fig. 2 Fig. 3 Fig. 4

Fig. 5 is the “foreman_qcif_0_rgb.bmp” Original image and Fig. 6 is the “foreman_qcif_0_rgb.bmp” subsampled version of the image in the RGB color space. I can’t tell the difference between Fig.5 and Fig.6

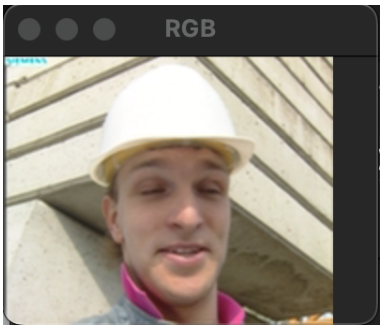


Fig. 5

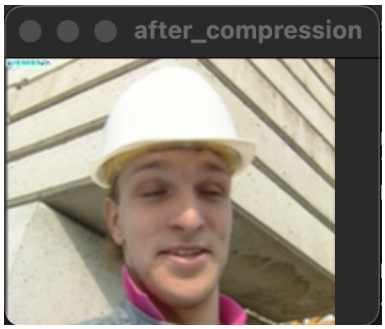


Fig. 6

Question 2

I have transformed “foreman_qcif_0_rgb.bmp,” “foreman_qcif_1_rgb.bmp,” and “foreman_qcif_2_rgb.bmp” from the RGB to YCbCr color space. I save 4:2:0 YCbCr format in the file ‘question2_with_subsampling.yuv’ and 4:4:4 YCbCr format in the file ‘question2_without_subsampling.yuv’. Fig7~9 are file ‘question2_without_subsampling.yuv’ open in YUVDisplay.exe. Fig10~12 are file ‘question2_without_subsampling.yuv’ open in YUVDisplay.exe.

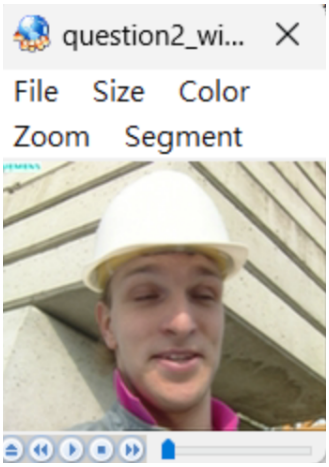


Fig. 7

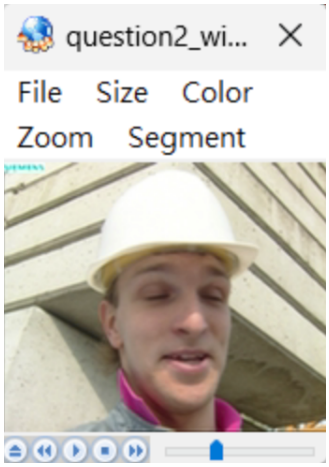


Fig. 8

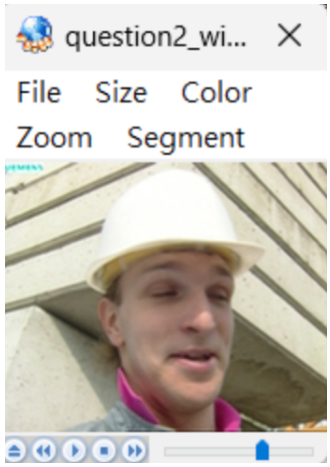


Fig. 9

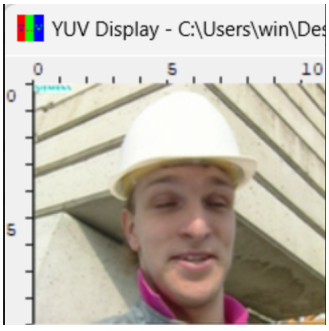


Fig. 10

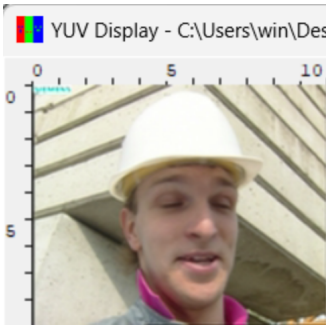


Fig. 11

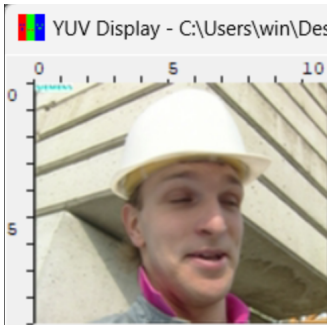


Fig. 12

Question 3

I read the file ‘question2_without_subsampling.yuv’ to get 3 YCbCr frames and quantify all possible intensities evenly in 8 levels. Fig. 13 is the Huffman tree in question 3. Fig. 14 is the table for Huffman coding with code, symbol, and probability.Fig. 15~17 are the YCbCr frames after Huffman decoding and dequantization.

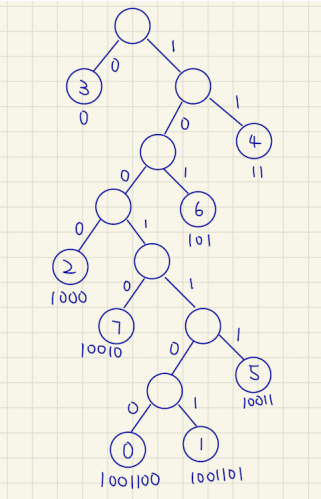


Fig. 13

code	symbol	probability
1001100	0	0.00182818
1001101	1	0.00529163
1000	2	0.0462919
0	3	0.395956
11	4	0.373273
100111	5	0.0277997
101	6	0.120668
10010	7	0.0288913

Fig. 14

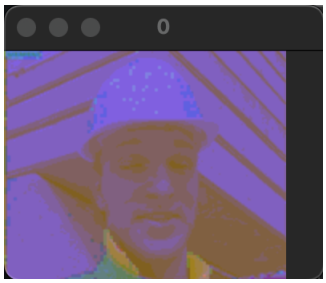


Fig. 15

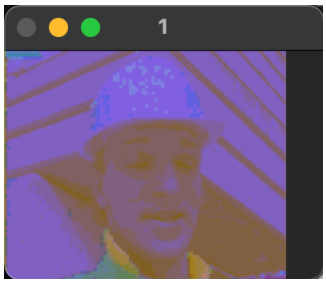


Fig. 16

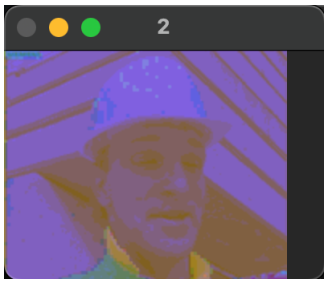


Fig. 17